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How Statistics Help Engineer Control Product's Quality (page 109)

May 1940

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RUTH E. MASON, *Editor*

This Issue

Our Front Cover: **An electrical measuring device is used to check the alkali strength of the cleansing bath to assure uniform cleanliness for wool used in making carpets. (See also picture page 110.)** ***Photo courtesy Alexander Smith & Sons Carpet Company.***

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How Statistics Help the Engineer Control Quality of Product

"The successful quality control engineer, like the successful research worker, is not a pure reason machine, but instead is a biological unit reacting to and acting upon an ever-changing environment."
—Walter A. Shewhart

A Review of Walter A. Shewhart's "Statistical Method from the Viewpoint of Quality Control"[1]

by
John Gaillard

Mechanical Engineer,
American Standards Association

THE engineer who receives no special training in statistics is inclined to look upon its methods as something largely academic. He should, however, recall innumerable cases where industry uses the findings of exact science for solving its practical problems. Inspection of parts by means of limit gages which are checked by gage blocks, themselves certified on the basis of lightwave measurements, is such a case. Just as the inspector can use these gages effectively without being expert in lightwave measurements, so may the quality control engineer use the techniques developed by the statistician without understanding fully the mathematics underlying them.

The statistical approach to quality control is a recent development. To visualize its future importance, its present stage might be compared with the first introduction into practice of limit gages, some seventy years ago. The adoption of manufacturing limits embodied in a Go gage and a Not Go gage was a major development which helped to make mass production what it is today. Similarly, the use of action or control limits, in addition to manufacturing or tolerance limits, has a great significance, because they give us a firmer grasp on the quality-control problem and permit us to go to the extreme in efficient use of materials and component parts.

Shewhart's new monograph, *Statistical Method from the Viewpoint of Quality Control,* is a valuable addition to his treatises on the tools which the statistician has placed at the disposal of the engineer to help him solve his production problems.[2]

The quotation which heads this review assures us that the author does not expect to solve these problems by means of pure mathematics, but that he keeps in mind continually the human value inherent in industrial activities. Quality, in the final analysis, is determined by human judgment, but to be able to discuss quality we must establish definite means of determining and expressing it. Shewhart recognizes that while mathematics may

[1]A series of four lectures given in 1939 at The Graduate School, The Department of Agriculture, Washington, D. C., by Walter A. Shewhart, Member of the Technical Staff, Bell Telephone Laboratories, edited by W. Edwards Deming and published by The Graduate School. Price $2.50.

[2]Shewhart's earlier book, *Economic Quality Control of Manufactured Product* (Van Nostrand, New York, 1931) deals fully with the theory and technique underlying the statistical approach to the quality control problem.

Courtesy Alexander Smith & Sons Carpet Co.

Scouring the wool — a preliminary process in carpet manufacture, where control of quality is essential

In carpet manufacture, the scouring process is of basic importance because uniform cleanliness of the wool is essential in later processes (spinning, dyeing, finishing, etc.) as well as for satisfactory service and wear of the carpet. To obtain this uniform cleanliness, the alkali strength of the bath is checked by means of an electric measuring device (as shown on our front cover). Samples of the ether extractable fat are taken several times daily from the end of the scouring machine, and their measurements are plotted on a chart giving two control limits (see inset above). The chart shown here indicates that in January there was lack of control, but that this condition improved in February and March.

serve to clarify a concept, we need something else to be able to work with it. He says:

> **"The formal and abstract mathematical theory has an independent and sometimes lonely existence of its own. But when an undefined mathematical term . . . is given a definite operational meaning in physical terms, it takes on empirical and practical significance. Every mathematical theorem involving this mathematically undefined concept can then be given the following predictive form: *If you do so and so, then such and such will happen.* Hence the process of making a physical application of the mathematical theory consists in specifying the *human operations* by which physical meaning is given to the mathematically undefined terms. We can then proceed to determine if the resultant predictions of physically observable events suggested by carrying out the associated mathematical operations are valid."**

Curiously enough, this attitude is essentially the same as that of the practical man faced with the task of getting things done—who may be rather disdainful of anything related to mathematical concepts. His attitude that "only results count" is merely another way of saying that the meaning of things is to be interpreted solely in terms of the results of human operations. Hence, these two entirely different ways of thinking really are not so far apart on essentials as one would assume at first sight.

The close cooperation between the engineer and the statistician advocated by men like Shewhart is just as logical as is cooperation between users and makers of physical tools. The average user of a tool cannot hope to become an expert in making it and the toolmaker can give the user best service only if he has a clear picture of the latter's

needs. The same relation exists between engineer and statistician in regard to the problem of quality control. The statistician can supply the engineer with tools which the latter could not produce himself. However, in order that the engineer and the statistician may agree on what tools are needed, and where and how they are to be used, they must learn to speak the same language insofar as they are dealing with a common problem.

To visualize the advantages of the statistical approach, we shall first review briefly the several steps followed in the practice of quality control worked out by the engineer without the help of the statistician and called, for the purpose of this review, the "traditional" practice.

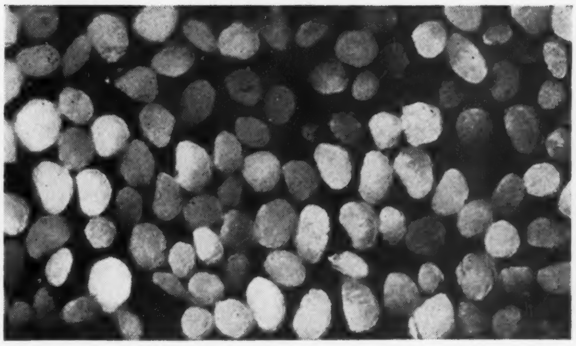
Traditional Quality Control Practice

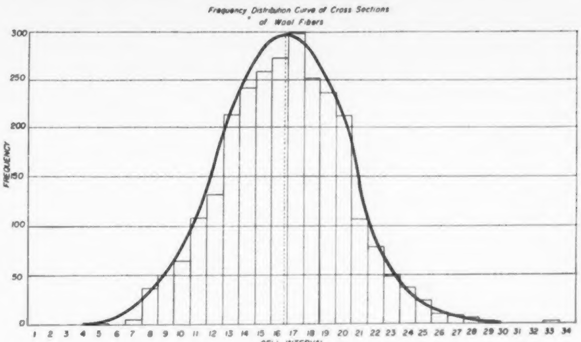
Let us assume, as a simple illustration involving only one quality characteristic, that a manufacturer has to produce, in large numbers, cylindrical steel pins with a nominal diameter of one inch. With a view to the technical performance of the pin as a component of the mechanism to which it belongs, the manufacturer adopts the manufacturing limits 1.0000 and 0.9997 inch. That is, any pin with a measured size lying within the tolerance of 0.0003 inch bounded by the limits will be acceptable. The shop makes a run of pins. These are inspected and some of them appear to be outside the limits. Investigation of the rejections discovers certain causes of excessive variation; for example, wear in the spindle bearings of the production machine. After these causes have been removed, a new run of pins is made, followed again by inspection and analysis of the findings. If after this cycle of operations has been performed a number of times, the sizes of all pins produced are found to remain within the manufacturing limits, the manufacturer says that quality is under control. New causes of excessive variation may sneak in which he will have to detect and remove. But apart from this, a condition has been reached where variation in the size of the pins may be left to *chance*.

Questions Arising in Traditional Practice

When the manufacturer has attained the desired degree of control, the question may arise: Should he try to improve his control by narrowing the limits? And if he tried, would he succeed in doing so?

The manufacturer is likely to dismiss these questions from his mind because a narrowing of the limits is always accompanied by a rise in production cost. Therefore, the manufacturer feels that since he has attained the control he wanted, why should he try to go further? Better leave well enough alone.





Courtesy Alexander Smith & Sons Carpet Co.

Above: Cross-section of wool fibers used in making carpets. Below: To get a picture of the distribution of fiber diameters in the cross-section shown above the control engineer plots this frequency curve

From the standpoint of workshop practice, this reasoning is sound. But the manufacturer overlooks the fact that control of quality between narrower limits will enable him to make a more economic use of materials and component parts. The less confidence the engineer has in the control of quality of a material, the higher will be the "safety factor" he adopts in his designs. Consequently, material is wasted in all cases where the safety factor could have been lower than the one adopted. Therefore, the savings made by more economic use of material may outweigh the higher cost of control between narrower limits. In traditional practice, the manufacturer probably does not think of this possibility due to the very fact that he is bent on using the widest possible tolerances compatible with good technical performance of his product. And if he does realize the advantage that may lie in a narrowing of the tolerance, he will not know how far he can go with a view to economy in production.

At the meeting of the ASA Company Member Forum, October, 1939, Dr. Walter A. Shewhart gave a talk on the statistical control of quality and the following engineers described the practical application of this statistical method to their own industrial problems:

A. G. Ashcroft, Alexander Smith & Sons Carpet Company

Harold F. Dodge and W. W. Werring, Bell Telephone Laboratories

R. F. Passano, American Rolling Mill Company

R. E. Wareham, General Electric Company

Dr. Shewhart's talk and the discussion were received with great interest by the standardization engineers who attended the Forum meeting.

Because of the increasing attention this subject is receiving, as evidenced at the October Forum, the American Standards Association is pleased to present this review of Dr. Shewhart's most recent book on the statistical method as a tool for quality control.

Possibly the manufacturer does *not* succeed in getting control within the limits adopted. In spite of his efforts to remove causes of excessive variation, he continues to get too large a percentage of rejections. In the example cited here, he must then take recourse to selective assembly, instead of basing assembly on interchangeability of parts. Also, he must inspect all of the units produced, lest too many rejections slip through. However, individual part inspection is always costly, often impracticable due to the large number of units produced, and technically impossible in all cases where the inspection is destructive. Therefore, when the manufacturer does not attain control, the important questions arise: Has he actually done all he could to eliminate causes of variation? Or has he overlooked an opportunity and is there any criterion that will indicate to him whether or not he still may be able to get control between the limits adopted—or perhaps even between narrower ones?

Traditional practice gives no answer to such questions; the manufacturer will have to find his way by trial and error. But the statistician, basing on mathematics, has developed an approach to the problem of quality control which the manufacturer can apply in practice. This approach centers around the concept of *statistical control* discussed in Chapter I of Shewhart's monograph.

Statistical Control

The concept "statistical control" appears in three forms: as a *state* of control; as an *operation* performed to attain this state; and as a *judgment* as to whether or not this state exists. As the counterparts of these three forms in mass production we recognize *specification, production*, and *inspection*.

Shewhart first discusses the state of statistical control as a mathematical and physical concept and shows that it is not possible to describe either by means of a formula. It should be visualized as the ideal that would be attained if we could reduce the totality of causes of variation to a constant system. No unit of the product would then ever have a quality exceeding the limits specified for it. The only way of determining whether a state of statistical control has been reached would be through an *infinite* number of quality tests on individual units. Since our sequence of tests is bound to be finite, we never can be certain that the state of statistical control exists. However, the statistician can supply us with criteria that can be used to decide whether there is a probability that the state of control exists—a probability that practically amounts to a certainty.

The Concept "Random"

To formulate these criteria, the statistician reasons somewhat as follows. If a state of statistical control exists, operations performed under this state must give results which, expressed as numerical values, stay within certain limits. However, the results will still vary *within* these limits, but since the cause system is a constant one—or in other words, there is no assignable cause of variability—their variation will be *random*. Conversely, the statistician reasons, when a series of observations, such as the results of tests made on samples drawn from a batch of product, are found to indicate randomness in their distribution, it appears reasonable to assume that the samples were produced under a constant system of causes, or in other words, under a state of statistical control. Here again, we must realize that, theoretically, this assumption is valid only if based on an *infinite* number of observations. Therefore, with the concept "random" we get into the same kind of difficulty as we did with the concept "state of statistical control": both are fundamentally tied up with a check on an

infinite number of observations. To get a workable scheme, we need a criterion that can be used with a *finite* number of observations.

Model of a State of Statistical Control

Therefore, the statistician proceeds in the same way as does the engineer: he builds a physical model representing the mathematical concept of a state of statistical control. It consists of a bowl containing a large number of physically similar chips each of which carries a numerical value. These numbers are distributed normally about a given value. Therefore, the contents of the bowl represent, with close approximation, a "normal universe." After the chips have been thoroughly mixed, one of them is drawn from the bowl at random—that is without any known cause favoring the drawing of a specific chip. The numerical value carried by the withdrawn chip is recorded and the chip is replaced in the bowl. Thereupon, the chips are mixed again and the process is repeated as many times as desired.

Here, then, we have an artificially constructed universe known to be in a state of statistical control and having a known distribution. The operation of drawing a chip is, for all practical purposes, a random one and can be repeated at will. Therefore, while we cannot perform an infinite number of drawings, we can make their number approach infinity as closely as we want.

The statistician can experiment with this model and draw conclusions from the magnitudes of the numerical values drawn and the order in which they are obtained. An important conclusion reached in this way by the statistician is "that the difference between samples drawn under such conditions are predictable in a probability sense and that there is nothing we can do to reduce the variability in the complexion of the samples" (Shewhart, p. 10). That is, the statistician can make here valid predictions concerning the probable percentage of observations (numbers drawn from the bowl) that will fall within any set of limits in which we are interested. And since it appears that nothing can be done to reduce variability further, we need not spend any effort on detecting causes of variation, but must accept the condition reached as indicating control between the narrowest limits practicable under present conditions.

Before relying on the results obtained by working with a physical model of a normal universe (bowl of chips) it is necessary to find out how closely these results agree with the mathematical theory of distribution on which the statistician bases his predictions. Shewhart says: "It is the practical man's good fortune that mathematical distribution theory seems to agree so closely with what he gets in drawings from an ideal experimental universe."

Number and Order of Observations

A decision as to whether a state of statistical control appears to exist must be based on a relatively large number of observations. In general, not less than 25 samples of four are required and in cases where we want to be "practically certain that we have attained the state of statistical control, it may be necessary to have a longer sequence of four." An example of such a case is the establishment of "economic minimum tolerances for a given quality characteristic" where "it may be necessary . . . that a total sample of not less than one thousand give no indication of the presence of assignable causes."

Furthermore, the significance of the *order* of observations is discussed. For example, if a set of numerical values varying at random about a central value, are presented in the order of their magnitude, they would appear to indicate a trend and hence, the presence of one or more assignable causes of variation. Therefore, it is important in presenting data not to distort the picture of a series of original observations by a grouping that might lead to misinterpretation.

On a similar ground, the division of observations into "rational subgroups" is recommended. This will facilitate the location of assignable causes. A simple example is the case where parts of the same kind are produced by several machines. Here, the batches coming from each machine should be kept separate, for inspection; otherwise, valuable detail information will be lost in the mass of observations.

Action or Control Limits

Experience has shown that if the distribution in the universe is normal, practically all of the observations will lie within the limits $\overline{X} \pm 3\sigma$, in which $\overline{X}$, represents the average of n observations made and σ, their standard deviation from this average. This finding has been used as the basis for designing a practical test as to whether the state of control exists in a given case. For example, in mass production, the test is made by drawing first a series of n samples from the batch manufactured.[3] Each sample gives an observation, the values $\overline{X}$ and σ are determined, and the control limits $\overline{X} + 3\sigma$ and $\overline{X} - 3\sigma$ are set. If observations are lying outside these limits, this

[3]Each sample may consist, for example, of four units, the average of their quality measurements being taken as one observation.

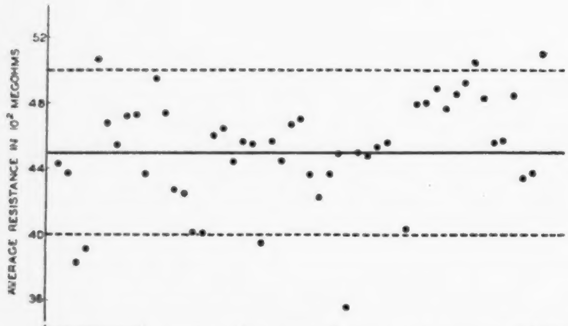


Fig. 1

Several of the measurements made on samples and plotted in this chart exceed the control limits set for them. This suggests the presence of assignable causes of variability in quality and consequent lack of control in the manufacturing process of the product inspected

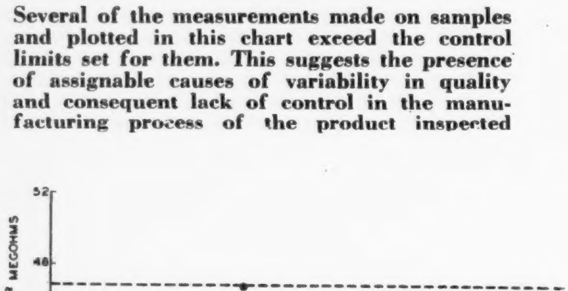


Fig. 2

On the basis of lack of control indicated in the chart, Fig. 1, certain causes of variability in quality were found and removed. In the new chart, shown here, the data plotted stay within the limits. This may be taken as evidence that a state of statistical control has probably been reached. (Note: The new limits are narrower than the original ones.)

fact indicates the probable presence of assignable causes of variation and, hence, suggests that these be found and eliminated. After this has been done, experience shows that further observations will cluster more closely about their average. The process may be repeated until the state of statistical control has been reached in which case practically all observations—99.73 per cent, according to the probability predicted by the statistician—remain within the limits $\overline{X} \pm 3\sigma$.

Control Chart

A practical application based on the experience just described is the control chart developed by Shewhart and his group of collaborators in the Bell Telephone Laboratories[4]. Fig. 1 shows such a chart on which are plotted 51 averages of four resistance measurements each, made on 204 pieces of a new kind of product. The fact that several measurements fall outside the limits suggests lack of control. After certain causes of variability had been found and removed, the chart shown in Fig. 2 was made. Here, the measurements stay within limits narrower than those in Fig. 1. "It is important to keep a running report as a basis for quality in mass production because such a report may indicate *progress* toward the attainment of a state of control even though such a state has not yet been attained" (Shewhart, p. 115).

Advantage of Statistical Approach

In the traditional approach, we have two limits serving as the boundaries of a manufacturing tolerance and, hence, called *tolerance limits.* In the operation of statistical control, two *action or control limits* are set up to "call attention to evidence for believing that the manufacturing process includes assignable causes of variation in the quality that may give trouble in the future if they are not found and removed" (Shewhart, p. 24). The action limits, which give the control engineer definite guidance in what to do next, may lie inside the tolerance limits adopted as satisfactory with a view to technical performance of the product. If so, it is not necessary to reject the product lying outside the action limits but inside the tolerance limits. However, the control engineer may decide to narrow the original tolerance limits anyway with a view to economic use of material. The use of action limits is, therefore, comparable to the use of a reagent by the chemist to indicate the presence of an acid in a fluid. Depending on his findings, he may or may not want to do something about the reduction of the acid content.

Comparison Between Traditional and Statistical Approach

To visualize the advantage of the statistical approach over the traditional, Shewhart illustrates the industrial forms of the three steps of quality control—specification, production, and inspection—in a diagram, Fig. 3. Referring to the older method he says: "One could specify what he wanted, some one else could take this specifica-

[4] For a complete description of this chart, see Shewhart's book referred to in footnote 2 of this review.

tion as a guide and make the thing, and an inspector or quality judge could measure the thing to see if it met specifications. A beautifully simple picture!" In the "old" method (Fig. 3) the three main steps are shown as being independent from each other while in the "new" method they are closely tied up. The action limits required in step II must be adopted on the basis of results obtained with tolerance limits set in step I. However, such tolerance limits cannot be adopted without experience previously obtained in step III. The steps "must go in a circle instead of a straight line" or still better, they should be shown "as forming a spiral gradually approaching a circular path which would represent the idealized case where no evidence is found in step III to indicate a need for changing the specification (or scientific hypothesis), no matter how many times we repeat the three steps. Mass production viewed in this way constitutes a continuing and self-corrective method for making the most efficient use of raw and fabricated materials."

The essential difference between the two approaches could hardly be brought out more clearly. However, where the author represents the old system as consisting of three entirely independent steps, I believe a slight correction is needed. In the best traditional practice also, the results of inspection obtained in step III are used for re-adjustments in steps I and II. In many well organized inspection systems rejections must be reported at once to the production line so that their causes may be found and removed as soon as possible. In a treatise on Control of Quality, G. S. Bradford says that the foreman-inspector "is excellently situated to locate production troubles, frequently to isolate their causes, and sometimes to offer suggestions for their cure"[5].

It is true, however, that in traditional practice, this process of "feeding back" information obtained from inspection is not directed in a positive way, as it is in the statistical method. Here, the engineer can take his bearings and plot his course, thanks to the mathematical equipment supplied him by the statistician. Therefore, it would seem that the difference between the statistical and traditional approaches lies essentially in the availability of this equipment and the positive guidance it gives the engineer, rather than in the inter-dependence and independence, respectively, of the three steps in quality control.

Existence of State of Control

It is necessary to determine first whether the state of statistical control exists before the statistician is asked to make certain predictions

[5]Management's Handbook, Ronald Press Co., New York, 1924 (p. 720).

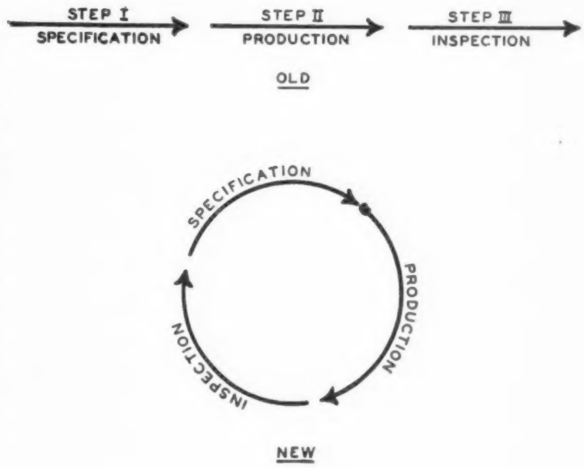


Fig. 3

This chart shows independence and interdependence of the three main steps in control of quality

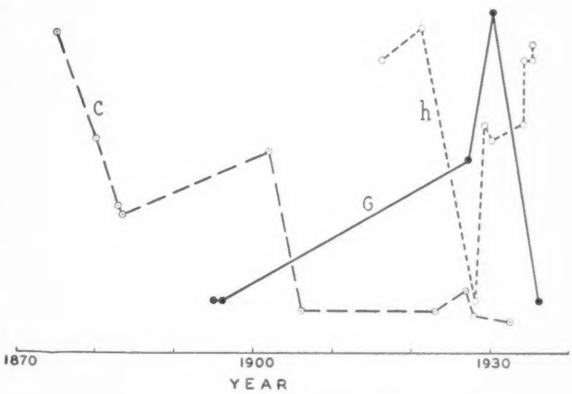


Fig. 4

Absence of the state of statistical control is found even in data obtained by scientific research, as shown in the above diagram representing measurements of three fundamental constants of physical science: the velocity of light (*c*); the gravitational constant (*G*); and Planck's constant (*h*)

based on the distribution theory. Shewhart says: "My own experience has been that in the early stages of any attempt at control of a quality characteristic, assignable causes are always present even though the production operation has been repeated under presumably the same essential conditions" and also that "physical states of statistical control are indeed rare natural occurrences, at least in physics and engineering."

In support of the latter statement a few examples are given in Chapter II which are unusu-

ally interesting to the engineer since they show that data obtained by research in pure science often represent a condition far more remote from the state of statistical control than do mass production data once the manufacturing process has been subject to an operation of statistical control. Thus, the author analyzes measurements of the velocity of light and shows that it is highly improbable that the variations in these data are due to a constant cause system (Fig. 4). In other words, the observations in question—which, as the author says, "certainly . . . are among the elite of all physical measurements"—obviously were not made under "essentially the same conditions." Offhand, this finding will astonish engineers who are accustomed to think of scientific measurements as having a much higher precision than industrial ones. This assumption is based largely on the fact that in general the scientist can spend much time, effort, and money on the refinement of his operations, while the engineer, at least in manufacturing, always has to keep in mind cost of operation. Shewhart shows that this common assumption is wrong because mass production, on account of the millions of units made, presents a much better field for using statistical tools for the removal of assignable causes of variation than does scientific work. Thus, a determination of light-wave velocity reported in 1935[6] was based on 2885 observations—a large number, for a scientific investigation of this scope. Yet, if a manufacturer decides that it is worth his while to make 100,000 observations in order to get statistical control of quality, this may prove to be a far easier task than it was for the scientists to make their 2885 observations on light velocity. Referring to absence of control in scientific observations, Shewhart says:

"In the light of such experience in the investigation of available measurements of the physical constants and in the light of my experience in the study of samples of measurements of quality in engineering, I feel that before one turns over any sample of data to the statistician for the purpose of setting tolerances, he should first ask the scientist (or engineer) to cooperate with the statistician in examining the available evidence of statistical control. The statistician's work solely as a statistician begins after the scientist has satisfied himself through the application of control criteria that the sample has arisen under statistically controlled conditions."

How to Establish Limits of Variability

Chapter II deals in more detail with the setting of economic tolerance limits. This concerns two types of problems—the setting of tolerances on the quality characteristics of "raw and fabricated materials and pieceparts" and of "the completed unit, physical system, or engineering structure." "From an engineering viewpoint, these two problems, broadly speaking, may be considered as belonging in the field of research on the quality of materials on the one hand and in that of design on the other."

The requirements for setting tolerances are analyzed for cases where a state of statistical control exists and for cases where it does not—as in the light velocity determinations referred to before. In cases of the latter type, the chance of making an error in setting a tolerance range is much greater than under conditions of statistical control. As an example, reference is made to 5000 tensile strength data for malleable iron measured on test bars from 17 different sources. These sources do not indicate the existence of the state of control and if "they are to remain as uncontrolled as they are, one would simply take into account the best and worst sources as a basis for setting the tolerance limits. Then, since it is likely that each of these sources is not statistically controlled, one would have to allow for the effects of assignable causes as best he could. Oftentimes under such conditions the maximum and the minimum in the best and worst sources respectively are of more importance than any other statistics of these distributions for indicating the range in which most of the future observations will lie." This shows that our grasp on chance is much less tight here than it is in the state of statistical control.

The *consistency* between results obtained by different methods of measurement is discussed as "a powerful influence in directing attention to the so-called constant errors. It would appear that, in general, it is of little value to make very large numbers of measurements by any one method until it has been found to give results that are more or less consistent with those obtained by other methods."

According to the last paragraph of Chapter II:

". . . we must gain a much more intimate knowledge of the properties of materials than we now have if the engineer of the future is to minimize tolerance ranges and thereby attain maximum efficiency in the use of raw materials. Furthermore, it must be apparent that this ideal can be attained only by the application of statistical theory in establishing criteria for control and other criteria for testing consistency between methods of measurement. Even in establishing tolerances under conditions that are not statistically controlled, it is to the engineer's advantage to use statistical technique as an aid in segregating assignable causes of variability; and when a state of statistical control is reached, the setting of tolerance limits becomes a purely statistical problem."

The Presentation of Data

In Chapter III, entitled "The Presentation of the Results of Measurements of Physical Properties and Constants," the importance of the pres-

[6]By Michelson, Pease and Pearson.

entation of observed data is stressed on the ground that they represent the evidence on which predictions of the future behavior of the product are to be based or, in other words, the evidential basis for the engineer's knowledge of the quality characteristics of raw and fabricated materials—which knowledge is required for their most efficient use. The problem of how to present data arises in several phases of the quality-control problem. For example, a purchaser's rational belief that a supplier is maintaining control of quality can be based only on data currently submitted by the supplier as evidence. Of course, the presentation of data is also of primary importance where the engineer hands over data to the statistician for study and analysis.[7]

Shewhart's monograph deals with the presentation of data in different cases including those with, and those without, statistical control. In dealing with a universe represented by the"normal bowl," the striking thing is "that it is sufficient to tabulate merely the average $\overline{X}$, the standard deviation σ, and the sample size n; nothing else is of any use in the predictions here considered."

When no state of control has been reached, at least the maximum and minimum observed values should be tabulated in addition to the average $\overline{X}$ and the sample number n and with a view to establishing tolerance limits, also the different methods of measurement involved, since the latter may bring out "constant errors." The author reaches the conclusion "that statistical theory does not contribute much to the technique of presenting evidence upon which to base a tolerance range under conditions that are not statistically controlled. However, if for some reason it becomes necessary to close up on such a tolerance range by detecting and eliminating all constant errors, statistical tests for significant differences become . . . a necessary tool in the process."

Accuracy and Precision

In the fourth and last chapter of the monograph, Shewhart says that while the terms "accuracy" and "precision" are often used "loosely and interchangeably," the theory of errors makes it possible clearly to distinguish between the two concepts. A simple example—the measurement of a length—is used to illustrate the difference. A number of measurements of the length gives us an average. This average will approach more closely to a limit as the number of measurements increases. The limit that would be reached for an infinite number of measurements is called the *limiting average value or expected value* ($\overline{X}'$). This value differs from what is assumed to be the *true value* (X') by the *constant error* which gives us an idea how closely the measured values cluster about the true value. This is, roughly speaking, what we understand by the degree of accuracy of measurements. Similarly, the term "precision" applies to the way in which the measurements cluster about the expected value.

These mathematical descriptions do not give the engineer anything to work with in practice. We shall never know what the true value and the expected value are because their definitions are based on the assumption that an infinite sequence of measurements becomes available, while we are able only to produce a finite sequence. Therefore, the only way in which we can specify both accuracy and precision in practice is in terms of a tolerance range. Now, "the ranges used in defining the classical concepts of both accuracy and precision are . . . constant ranges conceived of as being tied down to fixed points,"[8] but the tolerance range to be used by the engineer as a "quantitative and practically verifiable criterion of either accuracy or precision" must be defined in each individual case, by specifying four items. Roughly stated, these are: (1) the physical operation of measuring accuracy or precision; (2) the number of measurements to be made; (3) for what function(s) of the observed values tolerance limits are to be set; and (4) the tolerance limits for each function.[9]

While theoretically this procedure would leave the engineer free to specify any tolerance range he pleases in defining requirements for accuracy or precision, his practical limit is set by the fact that tolerance ranges must be economic.

The Wider Significance

The statistical approach to quality control is of fundamental significance not only to those engaged in manufacturing, but also to standardizers whose job it is to turn out specifications of aimed-at quality characteristics. In fact, the rapid growth of standardization on a national and even international scale during the last twenty years is given by Shewhart as one of the two

[7]In recent years the presentation of data has been given special attention by engineering and scientific societies. See, for example, the 1933 ASTM *Manual on Presentation of Data* (second printing, 1937) prepared by an ASTM committee under the chairmanship of H. F. Dodge.

[8]These fixed points are the true value and the expected value, respectively, as just explained.

[9]In this connection it is interesting to note that a round table conference called by the ASTM in 1937 "Resolved that when a standing committee records or specifies a numerical value for precision in a standard, the committee should make clear what is meant in terms of operations or procedure to be followed for purposes of verification."

important reasons for the recent interest in the statistical approach to quality control. The other reason is the "more or less radical change in ideology" in science about 1900, involving the passing from the concept of exactness to that of probability.

Like standardization in general, the new approach to quality control is not merely a technical problem, but a problem in which executive management should be deeply interested. The three steps in mass production—specification, production, and inspection—"may involve the coordinated effort of literally hundreds and even thousands of employees." And, moreover, "the situation constitutes a problem not only for those now in industry but also for those responsible for the training of the industrial leaders of tomorrow so they will have sufficient knowledge of statistics to be able to recognize the potential contributions that statistical theory and technique have to offer."

Therefore, all efforts to promote cooperation between the engineer and the statistician for the purpose of solving problems of quality control fully deserve the attention of all industrial executives.

Tool Engineers Join ASA As New Member-Body

THE American Society of Tool Engineers has become a Member-Body of the American Standards Association and will be represented on the Standards Council, the Mechanical Standards Committee, and on a number of projects in which the members of the Society are interested. President of this national organization is A. H. d'Arcambal, chief metallurgist, Pratt and Whitney Division, Niles-Bement-Pond Company, Hartford, Connecticut. Ford R. Lamb is executive secretary, with headquarters in Detroit, Michigan.

The Society has a National Standards Committee, members of which this year are:

E. W. Ernest, Superintendent, Section A, General Electric Company, Schenectady, N. Y., *Chairman*
Clifford E. Ives, Owner, Ives Engineering Company, Chicago, Illinois
Carl J. Oxford, Chief Engineer, National Twist Drill & Tool Company, Detroit, Michigan

Steps have already been taken toward close cooperation between this committee and the ASA.

The tool engineer has a particularly important interest in the national standardization program since he is the man responsible for getting into production the idea conceived by the designer and laid down in drawings and specifications. This involves deciding what tools, equipment, and methods are to be used, and frequently requires the designing of equipment such as cutting tools, jigs, and fixtures. When changes are made in the product or method of production, the tool engineer may be called upon to advise in redesigning the entire equipment and to decide whether existing tools and equipment can be used, or whether new items must be built or purchased.

In many companies, increasing attention is being given to coordination between the work of the designer of the product and the work of the tool engineer. The success of a product on the market and as a result the very existence of a company may depend not only on how the product is designed for performance and appearance, but also how it is designed with a view to methods of production that will give best results at lowest cost.

The American Society of Tool Engineers which was started in Detroit some years ago has now some 4,000 members, in local chapters in close to 30 cities. Its members are kept in touch with the Society's activities through its monthly bulletin, the *Tool Engineer*.

James R. Weaver, of the Westinghouse Electric and Manufacturing Company, the ASTE president for last year's term, has been chairman of the ASA committee on Surface Quality (B46) for several years. The ASTE is also represented on this committee by Edward C. Lee of the Chrysler Corporation. The Society is expected to appoint members on a number of other ASA technical committees in the near future.

Bearce to Head Weights Division Of National Bureau of Standards

Henry W. Bearce, who has served with F. S. Holbrook as co-chief of the Division of Weights and Measures, National Bureau of Standards, from 1921 until the death of Mr. Holbrook February 4, has now been appointed chief of that Division by Dr. Lyman J. Briggs, Director of the Bureau.

Ralph W. Smith has been appointed assistant chief of the Division. Mr. Smith has headed the section on weights and measures laws and administration since 1924.

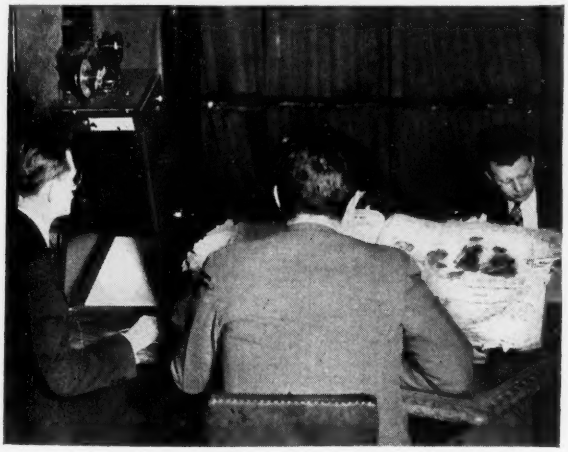
New ASA Committee Starts Work On Standards for Libraries

Three subcommittees are named to start national program and to cooperate with international standardization committee

A NEW ASA committee on Standardization in the Field of Library Work and Documentation (Z39) held its organization meeting in New York March 15. R. B. Downs, representing the Association of College and Reference Libraries, was elected chairman of the committee and Rollin A. Sawyer, representing the Association of Research Libraries, was elected secretary. The American Library Association accepted the administrative leadership for the committee's work, the scope of which is to cover standards for concepts, definitions, terminology, letters and signs, practices, methods, supplies, and equipment used in the field of library practice.

The new committee was organized upon request of the American Library Association, the American Association of Law Libraries, the Medical Library Association, and the Special Libraries Association. It will coordinate national standardization work in the library field and will represent American opinion in the international standardization work on Documentation.

This international project was started a few years ago by a committee organized under the procedure of the International Standards Association. The international committee (ISA 46) is working with the cooperation of such organizations as the International Federation of Library Associations and the International Institute for Documentation to bring about world-wide agreement on national standard practices in library work. The American Standards Association as a member of the ISA is represented on ISA committee 46 on Documentation by Miss Carolyn F. Ulrich, one of the two representatives of the American Library Association on the newly organized ASA committee on library work.



Courtesy N. Y. Public Library

Standards for microfilm technique will be studied by the new ASA Library Committee. This technique, as shown here, has become important recently as a substitute for reading original documents

Eight standardization proposals now under consideration in the international committee were considered by the new ASA committee in its first meeting, as a guide in deciding what subcommittees should be organized. It was decided that for the present the ASA committee should appoint three subcommittees, to cover:

1. **Reference Data for Periodicals**
2. **Bibliographical References, and**
3. **Photographic Reproduction of Documents**

This third subcommittee will include reproductions on paper as well as on film (microfilm technique).

The first subcommittee has three international proposals before it for study, one for an International Code of Abbreviations for Titles of Periodicals, the second for Marginal Identification of Periodicals, and the third for Form and Arrangement of Scientific Periodicals. It was also recommended that the work of this subcommittee should include revision of the American Recommended Practice, Reference Data for Periodicals (Z39.1-1935).

The second subcommittee will deal with Bibliographical references. There are now as many different practices in preparing bibliographies as there are authors, one member of the committee

declared in discussing the need for standards for bibliographical references.

In developing national standards for photographic reproduction of documents, subcommittee 3 is expected to coordinate its findings with those of the ASA committee on Photography. Therefore, it was suggested that the chairman of subcommittee 3 serve as the liaison representative of the committee on library work, on the committee on photography. The ASA committee on photography cooperates in the work of the international committee on photography (ISA 42), for which the American Standards Association holds the secretariat. Representation of the new ASA library committee on the ASA committee on photography should, therefore, bring about the proper coordination, both nationally and internationally, between the work on library standards and that on photographic standards.

An ISA proposal on standard formats for cards used by libraries was referred to Miss Ulrich for study, and it was suggested that an ISA proposal for the transcription of Cyrillic letters should be referred for advice to an expert still to be named.

Additional organizations will be invited to appoint representatives on the new committee, as recommended at the organization meeting.

Library Associations Join New ASA Library Committee

Members of the new ASA Committee on Standardization in the Field of Library Work and Documentation (Z39) at the time of the organization meeting, March 15, and their representatives on the committee are:

R. B. Downs*, Association of College and Reference Libraries, *Chairman

Rollin A. Sawyer*, Association of Research Libraries, *Secretary

American Association of Law Libraries, *Sidney B. Hill*
American Council of Learned Societies, *Dr. H. M. Lydenberg*
American Documentation Institute, *Watson Davis*
American Library Association, *Carolyn F. Ulrich*
American Library Institute, *Dr. Harrison Craver*
Association of College and Reference Libraries, *Robert B. Downs*
Bibliographical Society of America, *Dr. H. M. Lydenberg*
Medical Library Association, *Janet Doe*
National Research Council, *Dr. Henry A. Barton; Madeline M. Mitchell (alt.); Chauncey L. Williams*
Special Libraries Association, *Mrs. Ruth McG. Lane*
Association of Research Libraries, *Rollin A. Sawyer*

Other organizations are being invited to name representatives.

This committee will carry on its work under the administrative leadership of the American Library Association.

National Bureau of Standards Announces New Flow Meter

A new flow meter with which it is possible to measure accurately the variable discharge rates characteristic of certain types of plumbing fixtures was announced recently by the National Bureau of Standards.

This meter is now being used in the cooperative investigation of flows in plumbing systems, sponsored by the Plumbing Fixture Manufacturers Research Associateship and the National Bureau of Standards. Already, the Bureau announces, some hitherto undemonstrated peculiarities in discharge rates have been established.

The meter will tend to make the data obtained by Bureau engineers in studies of various plumbing problems more exact, and will be of service to the ASA Committee on Minimum Requirements for Plumbing and Standardization of Plumbing Equipment (A40) since these studies are furnishing background material for that committee.

The function of the meter is to catch the discharge water from a plumbing fixture or from a group of plumbing fixtures in a series of successive compartments, the motion of which beneath the discharge nozzle is accurately timed. To accomplish this, the meter is built with a rotating annular container or bucket, 50½ inches in outside diameter, 2 feet high, and divided into 60 equal segmented compartments. This container is mounted on a vertical shaft which is driven through a variable speed transmission by an electric motor. Any speed up to 6 rpm can be secured.

In making a test, the total time consumed in a discharge is noted, and the speed of the meter is so adjusted that a trifle less than one complete revolution is accomplished in this time. Then, as the plumbing fixture discharges, the annular container rotates and catches an amount of water in each compartment exactly proportional to the rate of discharge during the very brief interval of time that the compartment was under the discharge nozzle.

The water in the compartments is then drawn off through stopcocks into glass graduates where the volume is accurately determined. These results, when plotted against time, give a curve which shows every variation in the discharge.

Standards Council Meeting Acts To Get Vote on Standards

THE meeting of the ASA Standards Council April 18 resulted in initiation of a new project for safety in quarries, appointment of a new Committee on Procedure and Administrative Problems, approval of personnel and scope for three ASA sectional committees, and decision to send 10 standards to letter ballot for final approval.

In addition, the Council decided to grant proprietary sponsorship to the American Society for Testing Materials for the four American Standards on coal. Through this action the ASTM will now have authority to undertake revisions of these standards, with the understanding that the American Standards Association will be kept informed of any such action and that all revisions will be submitted to the ASA for approval.

The Standards Council also received reports from the Mining Standardization Correlating Committee, the Building Code Correlating Committee, the Advisory Committee on Ultimate Consumer Goods, and the Electrical Standards Committee.

Dr. R. P. Anderson, chairman of the Standards Council, reported that the Committee on Procedure and Administrative Problems of the Council had been reorganized. F. M. Farmer, vice-president, Electrical Testing Laboratories, New York, is chairman, and the following have been named as new members of the committee:

Alfred Iddles, American Society of Mechanical Engineers

Arthur S. Johnson, National Association of Mutual Casualty Companies

H. S. Osborne, American Institute of Electrical Engineers

L. F. Adams, National Electrical Manufacturers Association, was reappointed to membership.

The Council voted that any correlating committee which has shown that it has an interest in a project shall be given an opportunity to make recommendations concerning the scope and personnel of that project, and be permitted to appoint a representative on the sectional committee in order that the technical content of the standard can be correlated with other project work. This arrangement takes the place of a former action of the Standards Council, which voted in April, 1938, that "When any project is of interest to more than one field, the document should be referred to both (or all) correlating committees which claim to have any interest in the subject but without the necessity for a report from any correlating committee except the one having direct supervision."

The Council voted to send the proposed standard Rules for Rounding Off Numerical Values to letter ballot providing the American Mathematical Society is willing to act as endorsing sponsor as required in the ASA procedure for the General Acceptance Method. Under this method this proposed standard was submitted to ASA by a Standing Committee which had been appointed in 1932 by the general conference held under American Standards Association procedure to consider development of a standard for inch-millimeter conversion for industrial use. This standing committee also served as a special committee which drafted the American Standard Practice for Inch-Millimeter Conversion for Industrial Use (B48.1-1933). The proposed standard rules for rounding off numerical values now being considered by the ASA for approval as a separate standard were approved by the conference, and later by the ASA, as a part of the American Standard Practice for Inch-Millimeter Conversion for Industrial Use.

The other nine standards sent to letter ballot by the Council are:

Safety Rules for Radio Installation (C2.5)
Specifications for Rubber-Insulated Tree Wire (C8.16)
Standard Methods of Testing Molded Materials Used for Electrical Insulation (C59.1)
Soft or Annealed Copper Wire (H4.1)
Hard-Drawn Copper Wire (H4.2)
Medium-Hard-Drawn Copper Wire (H4.3)
Tinned Soft or Annealed Copper Wire for Electrical Purposes (H4.4)
Bronze Trolley Wire (H4.5)
Copper Trolley Wire (H4.6)
Hot-Rolled Copper Rods for Electrical Purposes (H4.7)

The scope of the project on Electricity Meters (C12) has been approved by the Electrical Standards Committee, C. R. Harte, chairman of the ESC reported, and the work of this project will cover:

Standards of practice for the maintenance and accuracy of watthour meters, demand devices, and auxiliary apparatus. Summary of installation practice for metering and auxiliaries. Definitions of units and technical terms relating to watthour meters.

A new project for copper wire has been set up to include all types of bare copper wire. Formerly there had been several different projects for the different types of wire, one project for soft or annealed copper wire, another for hard-drawn copper wire, one for medium-hard-drawn

copper wire, for tinned soft or annealed copper wire, and one for copper and bronze trolley wire. As outlined in its new scope the consolidated project will now cover:

Specifications for bare copper wire whether for use as bare electrical conductors or for use in making insulated wire and cable; also including copper and bronze trolley wire.

A new document describing the methods by which ASA sectional committees are organized and carry on their work, was approved by the Council and released for publication. It is now being printed and copies will be available from the American Standards Association without charge to any one interested.

ASTM Annual Meeting to Hear Technical Reports, Symposiums

The Annual Meeting of the American Society for Testing Materials, Atlantic City, June 24-28, will include several symposiums in addition to 22 technical sessions. The symposiums will cover:

Tools of Analytical Chemistry
Spectrochemical Analysis
Problems in the Classification of Natural Water Intended for Industrial Use
Significance of the Tension Test in Relation to Design
Radiographic Testing

Separate sessions will be given to papers on Methods of Testing, covering testing of volumetric glassware and speed of testing.

Technical sessions which will include reports of ASTM committees and presentation of technical papers will be held on the general subjects of corrosion; cement and concrete; non-ferrous metals; plastics, electrical insulation, and rubber; effect of temperature and creep; petroleum products; road materials and soils; fatigue; gray cast iron; malleable iron castings; and pearlitic malleable iron.

NEMA Ranks Standards High In 1940 Activities Program

Cooperation with the American Standards Association in the development, approval, and promotion of the use of American Standards is listed by the National Electrical Manufacturers Association as one of the projects planned for 1940, in its *NEMA Program for 1940.*

To carry out this project, NEMA appoints representatives on 62 project committees and four standing committees; reviews proposals for adoption as American Standards; instructs NEMA representatives on voting; publishes American Standards for which NEMA is sponsor; provides secretarial services for certain ASA project committees in which NEMA has a special interest; and provides financial support to the ASA.

"Certain standards for electrical products, whether originated by NEMA or by others, have national significance," the NEMA program explains. "This requires their adoption as American Standards under the procedure of the American Standards Association whereby all interested parties may have a voice.

"Similarly, electrical manufacturers are interested in American Standards established for many non-electrical products such as materials or parts, and may voice their viewpoints thereon through NEMA."

The need for national standards is particularly evident in the case of local legislation to regulate electrical installations and the sale and use of electrical products, NEMA declares. Two states and 77 municipalities have adopted regulations making it unlawful to sell certain electrical products unless they have been approved for sale and use.

"Where such legislation is enacted, it is highly important that approvals shall in every case be based upon conformity with a single set of nationally recognized standards, otherwise the industry might be faced with the impossible condition of a score or more different sets of standards, promulgated by as many different cities or states, each with its own testing laboratory," the NEMA program states.

The National Electrical Code on which NEMA is cooperating is one of the more important of these national standards.

The American Standard Safety Code for Mechanical Refrigeration, a revision of which was recently approved by the ASA, has also become of great importance to NEMA because of its use as a basis for city and state refrigeration codes.

The National Electrical Manufacturers Association also includes in its 1940 program a project for cooperation with the ASA on safety codes.

Bill Proposes Federal Control Over Occupational Disease Program

A bill (S.3461) which would establish Federal control over occupational disease legislation by the various states has been introduced by Senator Murray of Montana, and referred to the Committee on Education and Labor. The bill provides that Federal money would be available, upon the approval of the Secretary of Labor, to any state which submits a State plan which conforms to certain national policies proposed to be established by the law. Failure of a State to submit a plan acceptable to the Secretary would mean that the State in question would not have the benefit of Federal funds.

Building Code Committee Reports Show 5 Proposed Standards Near Completion

DRAFTS of several proposed standard building code requirements are nearing completion, and many other proposed requirements are now being prepared, the Building Code Correlating Committee, which coordinates the building code work of the American Standards Association, was told at its annual meeting March 29. When completed, the work of the committees under the Building Code Correlating Committee will furnish standard building code recommendations as the basis for adoption by municipalities.

Rudolph P. Miller, Consulting Engineer, was re-elected BCCC chairman at the March 29 meeting, and George N. Thompson of the National Bureau of Standards, was re-elected vice-chairman. Mr. Miller acts as representative of the American Society of Civil Engineers and the American Society for Testing Materials on the committee, and Mr. Thompson represents the National Bureau of Standards.

Members of the Executive Committee were also re-elected:

- Clinton T. Bissell, National Board of Fire Underwriters
- J. Andre Fouilhoux, American Institute of Architects
- Albert H. Hall, American Municipal Association
- Wm. Arthur Payne, Member-at-Large
- Edward W. Roemer, Building Officials Conference of America

Reports of the work now under way showed the following. The organizations listed in parentheses after the title of each project are taking the administrative leadership for the work of that project.

Building Exits Code—A9 (National Fire Protection Association) The Building Exits Code, the latest edition of which was approved by the American Standards Association this year, is gradually becoming a well seasoned document, although every year there are proposals for changes, the BCCC was told. The committee held a meeting March 15 at which revisions were considered.

Building Code Requirements and Good Practice Recommendations for Masonry—A41 (National Bureau of Standards, U. S. Department of Commerce) A drafting subcommittee is now rewriting the Department of Commerce Building Code Committee's Recommended Minimum Requirements for Masonry Wall Construction in the light of new information and developments. Some of the sections, notably those on concrete masonry and reinforced brick masonry have already been referred to cooperating organizations for criticism.

Building Code Requirements for Fire Protection and Fire Resistance—A51 (National Board of Fire Underwriters; National Fire Protection Association; U. S. Department of Commerce, National Bureau of Standards) A draft of these requirements, to be referred to a sectional committee of the ASA, is nearly half completed. Plans for the organization of the committee are now being considered.

Building Code Requirements for Chimneys and Heating Appliances — A52 (National Board of Fire Underwriters) An outline of four sections of a proposed standard and a draft covering construction requirements for chimneys and fireplaces have been prepared. Provisions for safe installation, maintenance, and operation of heating equipment are still to be developed. Underwriters' Laboratories, Inc., is conducting some research on clearances for heating equipment.

Building Code Requirements for Light and Ventilation—A53 (Federal Housing Administration; U. S. Treasury Department, Bureau of the Public Health Service) A second draft of proposed requirements has been prepared and will be considered by this committee at a meeting scheduled for June 7.

Proposed requirements for mechanical ventilation for different types of occupancies have been submitted to the ASA Committee on the Ventilation Code (Z5) for coordination with its work.

Building Code Requirements for Fire Extinguishing Equipment—A54 (National Fire Protection Association) It is expected that standards for the installation of automatic sprinklers, which are being revised by the National Fire Protection Association, may be the basis for part of the work of this ASA committee.

Administrative Requirements for Building Codes—A55 (American Municipal Association; Building Officials' Conference of America; Pacific Coast Building Officials Conference) A third draft of these proposed requirements have been distributed to the committee for consideration and will be discussed at a meeting to be held on June 6.

Building Code Requirements for Excava-

tions and Foundations—A56 (American Society of Civil Engineers) Seven subcommittees have been organized during the past year and have completed preliminary studies. It is expected that reports from all seven subcommittees will be distributed soon for consideration at a meeting early this summer.

Building Code Requirements for Iron and Steel—A57 (American Institute of Steel Construction, Inc.; American Society of Civil Engineers) Recommendations for building code requirements for structural steel drafted last year by the committee are still the subject for consideration by the Committee on Working Stresses. Specifications for steel joist floor construction are to be revised by the Steel Joist Institute, as a result of a meeting of the committee in 1939.

Building Code Requirements for Minimum Design Loads in Buildings—A58 (National Bureau of Standards) Four subcommittees are working on recommendations for dead loads, live loads (furniture and people), wind loads, and earthquakes. Recommendations have already been circulated to the committee on all four subjects, and may be published in several engineering magazines for criticism. A meeting of this committee is scheduled for June 5.

Building Code Requirements for Reinforced Gypsum Concrete—A59 (Building Officials Conference of America; Gypsum Association) A standard has been submitted to the Building Code Correlating Committee and the BCCC has informally referred it to the Advisory Committee on Working Stresses for advice on stresses. A compilation of information based on actual tests on constructions using reinforced gypsum concrete has been made to assist this committee as well as the Advisory Committee on Working Stresses.

Building Code Requirements for Signs and Outdoor Display Structures — A60 (American Municipal Association; Outdoor Advertising Association of America) Organization of this committee is nearly completed. Research

Representative Committee Coordinates Work Of ASA Building Code Committee

The 15 committees of the American Standards Association which are preparing proposed standard building code requirements are organized under the jurisdiction of the Building Code Correlating Committee. This committee, which coordinates the work of these technical building code committees, includes in its membership representatives of engineering societies, building groups, city officials, representatives of other governmental organizations, and insurance groups. Members are:

Rudolph P. Miller*, American Society of Civil Engineers and American Society for Testing Materials, *Chairman

George N. Thompson*, National Bureau of Standards, *Vice-Chairman

American Institute of Architects, *J. Andre Fouilhoux; Alexander S. Corrigill* (*alt.*); *Mellen C. Greeley; Theodore I. Coe* (*alt.*)

American Municipal Association, *William P. Capes; Albert H. Hall* (*alt.*)

American Public Health Association, *James L. Barron; W. Scott Johnson* (*alt.*)

American Society of Civil Engineers, *Rudolph P. Miller; Melvin S. Rich* (*alt.*)

American Society for Testing Materials, *Rudolph P. Miller, R. E. Hess* (*alt.*)

Associated Factory Mutual Fire Insurance Companies, *Arthur L. Brown, Herbert A. Sweet* (*alt.*)

Associated General Contractors of America, *William J. Goble*

Building Officials Conference of America, *Edward W. Roemer; Frank C. Keller* (*alt.*)

Federal Housing Administration, *Edward P. Vermilya*

Forest Products Laboratory, *J. A. Newlin; L. J. Markwardt* (*alt.*)

International Association of Governmental Labor Officials, *Herman B. Byer, John A. Ball* (*alt.*)

National Association of Builders' Exchanges, *C. G. Norman*

National Association of Real Estate Boards, *Arthur Bohnen*

National Board of Fire Underwriters, *W. E. Mallalieu; C. T. Bissell* (*alt.*)

National Bureau of Standards, U. S. Department of Commerce, *George M. Thompson; Vincent B. Phelan,* (*alt.*)

National Conservation Bureau, *Owen R. Jones*

National Fire Protection Association, *R. S. Moulton*

National Safety Council, *F. A. Davidson; R. L. Forney* (*alt.*)

Pacific Coast Building Officials' Conference, *Walter Putnam* (*alt.*)

U. S. Housing Authority, *A. C. Shire; Colin Skinner* (*alt.*)

Federal Works Agency, *C. W. Chamberlain; H. H. Waples* (*alt.*)

U. S. Public Health Service Federal Security Agency, *R. R. Sayers; J. M. DallaValle* (*alt.*)

Members-at-Large, *W. H. Crowell; Albert Kahn; William Arthur Payne*

on soil mechanics is being sponsored by the Outdoor Advertising Association of America to be carried on by Professor Rutledge of Purdue University. A draft in ordinance form has been prepared by the OAAA as the basis for the committee's work.

Building Code Requirements for Wood—A61 (National Lumber Manufacturers Association; Forest Products Laboratory, U. S. Department of Agriculture) The organization of this committee is nearly complete. A draft is now being prepared by the Forest Products Laboratory. Research is under way to find a suitable method for determining the strength of panels with plywood coverings. A method for calculating suitable loads for members with combined compressive and bending loads has also been worked out, and may be incorporated in the code.

Specifications for Water-Cooling Towers—A63 The Building Code Correlating Committee is requesting the Water Cooling Tower Association to continue work on a proposed standard.

Safety Code for Grandstands—Z20 (Autonomous Sectional Committee) Draft specifications for portable steel and wood grandstands have been accepted by the committee but are awaiting action by the American Institute of Architects and the American Society of Civil Engineers, which have been invited to serve as endorsing sponsors.

Committee of Experts Advises On Working Stresses

The Advisory Committee on Working Stresses is one of the committees organized by the Building Code Correlating Committee. It is not a technical working committee as are the other ASA building code committees, but was organized as a reliable independent consulting agency to advise the BCCC and the technical building code committees on safe stresses for the various materials used in building construction. The committee, which was organized in 1936, now has the following membership:

Frederick E. Schmitt, editor, Engineering News Record, *Chairman*
Theodore Crane, Yale University, New Haven, Connecticut
Henry D. Dewell, Consulting Civil Engineer, San Francisco, California
Almon H. Fuller, Iowa State College, Ames, Iowa
Lewis E. Moore, Consulting Engineer, Boston, Massachusetts
H. H. Morgan, Robert W. Hunt Company, Chicago, Illinois
Frank A. Randall, Structural Engineer, Chicago, Illinois
Clifford M. Stegner, Commissioner of Buildings, Cincinnati, Ohio
Hale Sutherland, Lehigh University, Bethlehem, Pennsylvania
Herbert L. Whittemore, Washington, D. C.
Wilbur M. Wilson, Research Professor, Structural Engineering, University of Illinois, Urbana, Illinois
Morton O. Withey, Professor of Mechanics, University of Wisconsin, Madison, Wisconsin

This committee has already presented recommendations to the Building Code Correlating Committee on allowable stresses for structural steel and now has before it a draft of a proposed standard on reinforced gypsum concrete.

Commercial Standards Specify Requirements for Sun Glasses

Two Commercial Standards for sun glasses, one covering ground and polished lenses, and the second covering blown, drawn, and dropped lenses, are now available from the Government Printing Office. Both standards are now before the American Standards Association and are being considered for approval.

"The use of colored glasses for eye protection has increased enormously during the last few years," says the National Bureau of Standards in its announcement of the new standards. "In quantity production of the lenses, defects may occur that will cause distortion of vision and discomfort to the wearer. The Sun Glass Institute, Inc., therefore, requested the assistance of the Bureau in preparing the present Commercial Standards, which became effective for new production on October 10, 1939.

"Ground and polished lenses are manufactured by a process similar to that used in making corrective ophthalmic lenses; blown, drawn, and dropped lenses are blown and shaped by means of heat, and are not subjected to grinding and polishing operations."

The recently published Commercial Standards cover requirements for material and workmanship, maximum light transmission, optical quality, tolerances for prismatic effect and focal power, instruments and methods of testing, and certification of quality of the respective types of sun glass lenses.

Copies of Commercial Standards CS78-39 and CS79-39 may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at five cents each.

Canadian Standards Association Announces Plans for Labeling Electrical Appliances

THE Canadian Engineering Standards Association announces that a plan went into effect May 1 whereby the CESA is taking over all responsibility for labeling and testing electrical equipment used in Canada to assure that such equipment meets the provisions of the Canadian Electrical Code. Up to the present time the labeling and testing program has been carried on by the Hydro-Electric Power Commission and the National Research Council, while the Canadian Engineering Standards Association has been responsible for preparing the standard specifications and performance requirements to which the equipment must comply.

Administration of the labeling program will be carried out by an Approvals Council of the CESA, consisting of representatives of the Hydro-Electric Power Commission of Ontario, the National Research Council, and the Approval Authority in each Province.

Arrangements have been made by the CESA with Underwriters' Laboratories, Inc., to conduct certain tests. American manufacturers of electrical equipment are to apply to the Canadian Engineering Standards Association for listing and must obtain listing before offering their equipment for sale in Canada.

The following announcement of its new plan has been received by the American Standards Association from the CESA with a request that it be published for the information of ASA Members. The announcement appears in full.

Special Notice—CESA Approval of Electrical Equipment

To satisfy the repeated requests of a wide representation of Canadian interests, in the electrical field, the CESA Executive Committee, in March 1939, authorized the organization of a special division to provide for approval of electrical equipment to be sold or installed in Canada. The CESA Main Committee confirmed this action in December, 1939. This proposal met with the unanimous approval of electrical inspection authorities in each of the provinces, and of power supply, manufacturing and electrical interests in general, throughout Canada.

Date of Inauguration—May 1st, 1940

An appropriate organization has been in the course of development during the past year and preparations were completed whereby the CESA Approvals Division would be in a position, by May 1st, 1940, to enter into agreements with manufacturers for the purpose of issuing approval of electrical equipment, and provide suitable labels for such equipment where it meets the requirements of the appropriate Specifications of the Canadian Electrical Code, Part II, and of prescribed tests performed by laboratories authorized for the purpose by the CESA.

Basis of Approvals

Approvals work will be carried out in accordance with the provisions of the Canadian Electrical Code, Part I (current edition) and the supplementary Standard Specifications of the CE Code, Part II. All current editions of Specifications of the Canadian Electrical Code, Part II published prior to February 1st, 1940, will be effective for CESA approvals purposes as of May 1st, 1940, and all Specifications under that section of the Code published after February 1st, 1940, will be effective as of date of publication or will be otherwise specifically marked as to effective date.

Procedure for Application for Approval

Applications for approval of electrical equipment should be made to the CESA Secretary, or to the Approvals Engineer at the addresses indicated below. An Approvals Manual giving general information and detailed instructions as to procedure in seeking CESA approval of electrical equipment is being prepared and will be available on request. Manufacturers are requested to ask for instructions as to the submitting of sam-

ples for testing, by applying to:

The Approvals Engineer, Canadian Engineering Standards Association, Approvals Division, Room 101, 8 Strachan Avenue, Toronto

or to

The Secretary, Canadian Engineering Standards Association, Approvals Division, 3010 National Research Building, Ottawa

Follow-up Inspection Service Agreements

By agreement with the Hydro-Electric Power Commission of Ontario, all *Follow-up Inspection Service* Agreements between the HEPC and manufacturers or submittors, that, at the time of the transference of Approvals work from the Commission to the CESA, are valid, will be assigned to the CESA, which body will thereafter be the responsible party to such agreements, in place of the Commission. As these agreements expire they may be formally renewed between the CESA and the other party or parties thereto.

In connection with the *Re-examination Service*, the CESA will permit its name, together with the number of the Approval Report, to be imprinted upon all "*CESA Approved*" electrical equipment, as was done under HEPC *Re-examination Service*.

Approvals Labels

All existing *Approvals Labels* bearing the name of the CESA and the HEPC that have not yet been used will be accepted by the Provincial Electrical Inspection Authorities until the stocks have been exhausted; thereafter, standard CESA labels, only, will be accepted.

Approvals Card Index and Printed List of Approved Equipment of the HEPC, Ontario

The card index record and the printed *List of Approved Electrical Equipment* embracing the details of approvals issued by the Hydro-Electric Power Commission of Ontario and in effect on April 30th, 1940, will be adopted by the CESA as of May 1st, 1940, subject to the general provisions of the CESA *Approvals Manual* relative to continued effectiveness of approvals.

On and After May 1st, 1940

the CESA is prepared to follow the procedure laid down in the CESA *Approvals Manual* for the issuing of approvals on electrical equipment for Canadian use. An effort will be made to send a copy of the *Approvals Manual* to all parties known to be interested, but to anyone who does not receive one, a copy will gladly be sent on request.

The CESA Approvals Division has agreed to take over and complete those applications for approval which have not on May 1st, 1940, been completed,—as would have been done by the HEPC under the former arrangement.

Caution

Please do NOT submit samples for testing to the Ottawa office. Ask for instructions as to the location of the laboratory to which they are to be sent. This will obviate unnecessary delay and expense.

Tissue Paper Recommendation Now Revised and Available

The Simplified Practice Recommendation for Tissue Paper, R46, has been revised and printed copies are now available, according to an announcement by the Division of Simplified Practice, National Bureau of Standards. This revision covers wrapping tissue, toilet tissue, and paper napkins. The recommendations were worked out jointly by manufacturers, distributors, and consumers, and reflect current practice in the industry. Copies, designated as R46-39, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at five cents each.

The original Simplified Practice Recommendation for Tissue Paper, adopted in 1926, was initiated by the Tissue Association, and this present revision is based on data submitted by that Association. Buyers who purchase tissue paper products manufactured in accordance with these standards can be sure of the size, basis weight, count fiber content, color designations, wrapping, marking, and packing, the Tissue Association declares.

British, Italian Draft Standards Available from ASA Office

The American Standards Association Library has just received from the British Standards Institution, draft specification for Electrical Protective Relays, CF (EL) 5531; and from the national standardizing body of Italy, a draft for Standardization of Lights for Ships (UNI 0306).

Members of the American Standards Association may obtain copies of the drafts from the ASA Library. The ASA will be glad to forward any comments on these proposed standards to the national standardizing bodies concerned. The final date on which comments can be considered for the Italian draft is June 30th and for the British draft July 29th.

How a Coordinated Attack Can Help Control Accidents Resulting from Slips and Falls[1]

Unprotected floor and wall openings, faulty ladders, bad housekeeping, slippery floor surfaces, are some outstanding causes for the bad record marked up for slips and falls in industrial accident statistics

ASA committees are now working on safety codes to help control these accident causes

by

Cyril Ainsworth

Secretary, ASA Safety Code Correlating Committee

EVER since individual plants and then industries as a whole first began to compile statistics to show the causes of accidents, slips and falls have overshadowed all others. Day after day and year after year slips and falls have plagued the safety engineer as well as others active in accident prevention work.

The title of this paper might lead one to believe that little or nothing has been done to solve this problem. The remarkable progress which has already been made in accident prevention by individual plants and by industry as a whole, however, is definite evidence that worthwhile efforts actually have been made toward its solution. First, therefore, it must be the purpose of this discussion to review what has been done, in order that those new to the work can have the benefit of the experience which has gone before, and in order to rekindle further activities on the part of those who may not now be giving as serious attention to the problem as was formerly the case. Second, the purpose of this paper must be to outline certain phases of the problem which have not yet been solved and which need the cooperation of everyone if a solution is to be reached.

The title of this paper further implies that there must be a technical solution which can be written down in black and white for all to follow. This is only partly true. Probably most of the remarkable progress which has been made in the past has been due to everyday watchfulness over little things, removal of the most obvious physical hazards, maintenance of good housekeeping (and that term is used in its most common sense), and the institution of broad educational programs designed to make the average employee completely conscious of the fact that he must do his part to improve the accident record due to slips and falls.

Must Be Energetic Program

These few tools, which have already been used, seem rather simple when written down in a few sentences. The activity represented by them, however, is the result of years of work and the simplicity of wording should not be misunderstood as implying an activity which can be carried on in a half-hearted manner whenever the occasion seems to demand. It is a program which must be followed continuously and energetically.

Let us examine for the moment one point where physical hazards causing slips and falls are being removed. These hazards are floor and wall openings. This point is stressed particularly because a study of such mass statistics as are available will definitely show that although much progress has been made, all that could be accomplished has not yet been done.

When the accident prevention movement first got under way, unprotected openings in floors, open-sided floors and runways, openings in walls, unprotected shaftways, and so on were very common. Such a thing as a toeboard did not exist. Materials, tools, and other objects were pushed over the edges of floor openings to fall below

[1]Address presented before the Eleventh Greater New York Safety Conference, April 16-18, 1940.

and injure employees. Such accidents were common. Not only were tools and materials often forced over the edge of the platforms, but men themselves fell through openings, over the edges of platforms, and down shaftways. Serious injuries occurred.

Industry tackled this problem, with the result that sound technical provisions were prepared for the construction of railings and toeboards. An outline was developed to show the locations where railings and toeboards should be installed. Hatchway covers were prescribed, and other technical solutions were developed. Not only were technical provisions developed by industry itself, but insurance and governmental groups also established such safeguards.

All this effort finally culminated in the development of the American Standard Safety Code for Railings and Toeboards to which all these groups have subscribed. This American Standard safety code now stands as the basic national document for preventing slips and falls by using technical methods to remove physical hazards.

Any plan for a coordinated attack on slipping and falling accidents which is to be put into effect in the future must take into consideration these technical provisions.

Another prolific source of falling accidents was the faulty ladder. A survey of almost any plant in the country at the time the accident prevention movement got under way would have disclosed the use of various types of improperly designed, home-made ladder equipment. Ladders were in use with split side rails, broken rungs, and other defects which no longer should be tolerated. Unfortunately such surveys today would show that similar dangerous and useless equipment is still in use in some cases. This is true even in face of the fact that sound technical specifications have been developed which will insure complete safety in the design and construction of ladders. Safe practices have also been established for maintaining and using this equipment. The American Standard Safety Code for the Construction, Care, and Use of Ladders furnishes this technical material for nation-wide use.

Standards Give Technical Solutions

With the exception of one particular classification of falls, technical solutions for the removal of physical hazards responsible for a large proportion of the falls have been prepared and are available to all concerned. These technical solutions can be found in the Safe Practices Pamphlets of the National Safety Council, the recommendations covered by the safety standards of the insurance groups, the safe practices and regulations of the various State and Federal regulatory bodies, trade association recommendations, etc. In addition all these recommendations have been correlated and coordinated into a consistent group

Photos courtesy Metropolitan Life Insurance Co.

Soapy floors cause slips and falls

Soapy water carried in an open pail is easily spilled. One solution is this spill-proof safety can

of standards of national significance under the procedure of the American Standards Association:

- The American Standard Code for Building Exits
- The American Recommended Practice for Safety in the Construction Industry
- The American Standard for Elevators, Dumbwaiters and Escalators
- The American Standard for Floor and Wall Openings, Railings and Toe Boards
- The American Standard for Protection of Workers in Foundries
- The American Standard for Sanitation in Manufacturing Establishments
- The American Standard for Design, Care and Use of Ladders
- The American Tentative Standard for Construction and Maintenance of Ladders and Stairways for Mines
- The American Tentative Standard for Laundry Machinery and Operations
- The American Standard for Lighting Factories, Mills and Other Work Places
- The American Tentative Standard for Logging and Saw Mills
- The American Tentative Standard for Paper and Pulp Mills
- The American Standard Textile Code
- The American Standard for Woodworking Plants

All these contribute some technical information on the prevention of slips and falls. Probably no single classification of accidents has been as well covered from a technical point of view as slips and falls. The progress which has been made is remarkable, but in spite of all the information which is available, slips and falls still stand out as the prominent cause of industrial accidents. More complete use of this technical material must be made if there is to be further progress.

It would appear from this that the only plan necessary for a coordinated attack on slipping and falling accidents is more complete use of the information and material that is already available. Unfortunately the situation is not quite as simple as this.

Floor Surfaces Studied

A very large proportion of the slips and falls occurring daily are due in one way or another to the nature of floor surfaces or the way in which such surfaces are maintained. This fact has been recognized for some time. In fact all the groups working in the industrial accident prevention field agreed some fifteen years ago to work together to find a solution to this difficulty. This agreement resulted in the formation of a committee operating under the procedure of the American Standards Association, known as the Walkway Surfaces Code Committee. This committee was organized, as I said before, fifteen years ago for the purpose of emphasizing the fact that we still do not have any definite recommendations which can be presented to all concerned as a solution to this problem. This fact was undoubtedly in the minds of those who planned this discussion, hoping that through the medium of this conference some technical facts, recommendations, or information could be secured which would enable this technical committee or some other group to put down on paper recommendations which would be of real value to everyone.

Fundamental Research Needed

For many years the ASA committee was active. It had not been working very long before it found that certain fundamental research would be necessary in order to obtain facts on which to base technical recommendations. Representatives of manufacturers of walkway surface materials were members of this committee. They agreed to provide the funds necessary to carry on this research, and with the cooperation of the National Bureau of Standards the research program was instituted.

The research had to be started from scratch. No one had ever tried to analyze walkway surface materials from the point of view of slipping and falling accidents. No machinery or testing equipment existed for analyzing floor surfaces to determine their resistance to slipping, and therefore new equipment had to be developed and procedures had to be established for making these tests. The facts obtained from the research program were published by the National Bureau of Standards in one of its handbooks. These facts and the conclusions reached from this research were then studied by the Walkway Surfaces Code Committee and a draft of proposed specifications prepared. These proposed specifications prescribed certain coefficients of friction for walkway surfaces located in specific building locations which, if followed, would prevent slips and falls at these points. These coefficients of friction were intended to apply under both wet and dry conditions.

Unfortunately the committee had been unable to obtain any statistical material which would enable it to determine conclusively whether the recommendations contained in this draft, based on the theoretical research program, were practical and possible of accomplishment. Naturally such recommendations stepped on the toes of the manufacturers of different classes of walkway surfaces materials. Humanly enough, these manufacturers did not want to see restrictions on the

use of materials which they manufactured written into any standards unless there was conclusive proof that this was absolutely necessary. The lack of statistical information to show the relation of accidents to the walkway surfaces involved made it impossible to convince the manufacturing representatives on the committee that the coefficients of friction which had been set up for walkway surfaces in particular locations were practical and reasonable. This resulted in blocking the progress of the work.

Subcommittee Studies Proposals

During the next five or six years several attempts were made to find an approach which would resolve this situation. Last October, at a meeting of the committee held in Atlantic City in connection with the National Safety Congress, a special subcommittee was formed to investigate this situation further. It is my understanding that proposals are being circulated among the members of this committee, but I have no information concerning the nature of these proposals which I can present for discussion.

I have, however, come to certain definite conclusions as a result of my personal relations with the work of this committee, and particularly in view of discussions which have been held during the past few months. These I am pleased to offer for whatever they may be worth and with the hope that they will be instrumental in obtaining from the members of this conference, either at today's session or in the very near future, information and suggestions which may prove to be of value in carrying this project forward.

You will remember that I have stated that the work of the Walkway Surfaces Code Committee has been toward setting up definite requirements for the walkway surfaces to be installed at particular locations. In other words, the committee has been chiefly looking to the future, hoping that it could guide architects, contractors, and engineers in their choice of walkway surface materials to prevent this type of accident in the future. It seems to me that the committee has failed to recognize the fact that millions of square feet of walkway surfaces are already in existence and that probably it is more important to specify the best methods of treating and caring for these surfaces than it is to talk about the types of surfaces to be installed in the future. Many studies of various methods and materials for treating surfaces now in use have been made by individual companies, individual building operators, and insurance and governmental groups. What is badly needed is a correlation of this information in order that definite conclusions can be reached and broadcast to all concerned.

It is probably safe to say that those who are

This stairway is provided with siderail and metal treads for safety. An ASA committee is now working on standards for safe walkway surfaces

responsible for the proper maintenance of walkway surfaces have investigated, tested, and tried a considerable number and variety of materials now available for cleaning and treating walkway surfaces. In some cases claims have been made that these materials will eliminate slipping and falling. Some of these materials, after application, do seem to provide this non-slip characteristic for a reasonable period of time. In most cases, the non-slip characteristic does not last for a sufficient period of time to be worthy of the name "non-slip." In saying that information of this character should be pooled in order that definite conclusions can be reached on the various methods of treating classes of walkway surfaces, it is not intended to infer that this should be done in order to condemn this or that material. However, pooling experience on the use of various classes of materials will permit development of sound specifications for materials, with the definite assurance that these specifications will provide lasting anti-slip qualities.

Methods of treating some classes of walkway surfaces will undoubtedly be very simple. Such information can be put together and made available to the general public within a very short time

A railing prevents accidents on this step-off

Above: **Corner before railing was installed;** ***Below:*** **The same corner today after installation of railing**

if the cooperation of all concerned can be secured. In other cases, the preparation of detailed specifications for maintenance materials will be more complicated and will require additional research. If, however, agreement can be reached as to the real necessity for such activity, the work can be pressed forward and completed within a reasonable period of time.

Many of the groups which have been endeavoring to find a solution to this problem within recent years have developed testing devices with which to determine the anti-slip qualities of walkway surfaces when treated with certain processes. However, the results of tests made with these devices cannot be coordinated and it seems essential, therefore, that some specific testing method must be established if uniform results are to be obtained and if specifications for materials used in treating surfaces are to be made effective. The establishment of a national testing procedure will mean that some of the pet methods developed by individual concerns will have to be discarded. I assume that those who have developed these individual methods will be willing to scrap their own ideas in favor of a concerted attack through methods agreed to by all concerned.

Hospital Committee at Work

One of the most important maintenance groups is now tackling its problem along these lines. The American Hospital Association, through its Committee on Standards and Specifications, has appointed a subcommittee which is now at work trying to develop standards and specifications for the treatment and maintenance of walkway surfaces now used in hospitals. Undoubtedly the work of this committee will be made available to the public, since the American Hospital Association is one of the important members of the Walkway Surfaces Code Committee. Other similar groups should be encouraged to do likewise, leaving to the Walkway Surfaces Code Committee the task of correlating the work of these several groups into uniform national specifications.

This still leaves the task of preparing specifications which can be used in the design and construction of future buildings. It is to be hoped that the subcommittee which was appointed last October and to which reference has already been made will bring forward a plan which will result in the development of specifications of this type. Certainly what is most needed in a coordinated attack on slipping and falling accidents, as far as walkway surfaces themselves are concerned, is a real recognition on the part of all concerned that a genuine problem exists. This recognition must not be confined to insurance companies who are required to pay the bills presented for accidents which have occurred. Governmental groups who feel some responsibility for preventing the recurrence of the accidents covered by the thousands of reports circulating through their agency must not be saddled with the entire responsibility. On the other hand, the solution to this problem must not rest solely with the building owner and manager in their desire to maintain and operate a building in such a way that accidents can not happen. These groups, as well as manufacturers of walkway surface materials, manufacturers of the various products which are on the market for treating such surfaces, architects, engineers, and any other groups which are commercially or technically interested in this subject must be willing to meet

with representatives of the groups already referred to and to work constructively toward a solution of this problem.

Of all the problems which have been faced by the safety engineering profession and other groups engaged in accident prevention work, this single problem of determining what is safe as a walkway surface and what, from the point of view of safety, are the best materials for treating and maintaining walkway surfaces, seems to be the only problem which remains unsolved. Up to the present time there has been little more than a demand that something be done. With this demand there must be a real desire to assist, a willingness to devote time and effort, a willingness to furnish all the material that is available, not only on the part of one or two of the important groups involved, but on the part of everyone.

What information do you have which you feel will be of value to the Walkway Surfaces Code Committee in its work, and in what ways are you willing to help?

U. S. Treasury Department Becomes ASA Member-Body

Following a meeting of the Board of Directors of the American Standards Association May 8 it was announced that the U. S. Treasury Department has become a member of the Association as the result of official action taken at the meeting.

In proposing affiliation, Herbert E. Gaston, Assistant Secretary of the Treasury, pointed out that "The work of certain Bureaus of this Department is such that they have considerable interest in the subject of standardization." The Coast Guard which operates under the Treasury Department has a stake in many standardization matters. This interest was materially increased last July when the Bureau of Lighthouses, which had previously operated under the Department of Commerce, long active in ASA affairs, was transferred to its jurisdiction.

The work of the Federal Specifications Executive Committee which operates under the Procurement Division of the Treasury is of great importance. This Committee coordinates the purchase specifications for items of non-military nature commonly bought by two or more government departments, and seeks to bring these specifications into harmony with the best commercial practices. It also develops new specifications. Its recommendations, with certain exceptions, are mandatory on all departments and independent establishments of the Federal Government.

Membership in the American Standards Association gives the Treasury Department a voice in all decisions on ASA standardization activities. The Department has already announced that Captain H. E. Collins, Director of Procurement, Procurement Division; and Rear Admiral H. F. Johnson, Engineer-in-Chief, of the U. S. Coast Guard, will serve as its representatives on the ASA Standards Council. Captain R. R. Tinkham, also of the Coast Guard, and N. F. Harriman of the Procurement Division, will serve as alternates.

The Board at its meeting also welcomed two new members: G. J. Ray, vice-president of the Delaware, Lackawanna and Western Railroad; and Wm. F. Groene, vice-president of the R. K. LeBlond Machine Tool Company of Cincinnati. Mr. Ray was nominated in January by the Association of American Railroads and Mr. Groene by the National Machine Tool Builders' Association. Both of these organizations have for many years been active in ASA work.

IES Recommendations Extended to Ceiling Lights

The good-lighting recommendations of the Illuminating Engineering Society were extended to ceiling lights with approval by the IES of a Recommended Practice for the Illumination Performance of Residential Ceiling Luminaires. The Society's requirements for study and reading lamps have resulted in wide acceptance and use of lamps bearing the IES seal.

Although specifications for construction were included in the case of the IES standards for portable lamps, the Society believes its proper function is the development of standards for illumination performance, according to its announcement of the new recommendations. For this reason the standard for ceiling luminaires does not include construction rules and is entitled a "Recommended Practice," not a specification.

The recommendations cover types of fixtures and illumination requirements, including light source, test requirements, brightness, and a table showing illumination in footcandles for light output, maximum brightness on the luminaire, maximum ceiling brightness, and minimum footcandles on horizontal plane 30 in. above the floor.

New ASA Project Takes Up Safety for Quarry Workers

CONCERN for the safety of workers in quarry, strip, and open-pit mining resulted in authorization of a new safety code project at a meeting April 18 held under the auspices of the American Standards Association. The need for such a code has been under consideration for some months in safety and mining circles, and the action taken at the April 18 meeting was strongly influenced by the results of an industry-wide canvass in which 23 organizations backed the proposal to develop a Safety Code for Quarry Operations, and expressed a desire to participate in development of the code. A committee representing these organizations and others will take charge of the technical work involved in developing standards.

Because of the accident hazard in quarry, strip, and open-pit mining, many states have instituted their own regulations for quarry operations. The National Safety Council has also studied the problem and issued a "Safe Practices Pamphlet" on the subject. A primary job of the new committee will be to coordinate these many existing federal, state, and city codes.

The work when completed will serve as a guide to safe practices for quarry and mine owners, and will also be available to insurance interests, governmental bodies, or other regulatory groups. By tending to unify the many local and sectional requirements covering health and safety of quarry workers, it should prove particularly helpful to the companies that operate in several states.

The National Safety Council is being asked to take the administrative leadership in the work.

23 Organizations Interested In Safety for Quarries

The 23 organizations which approved the proposal to develop a Safety Code for Quarry Operations and said they would be interested in taking part in the work are:

American Association for Labor Legislation
American Institute of Electrical Engineers
American Iron and Steel Institute
American Mining Congress
American Society of Mechanical Engineers
Coal Mining Institute of America
International Association of Governmental Labor Officials
International Association of Industrial Accident Boards and Commissions
Industrial Safety Equipment Association
Mine Inspectors' Institute of America
National Association of Mutual Casualty Companies
National Coal Association
National Conservation Bureau
National Electrical Manufacturers Association
National Lime Association
National Safety Council
Ohio Ceramic Industries Association
Pennsylvania Department of Labor and Industry
Pickands Mather & Company
Tennessee Valley Authority
U. S. Department of the Interior, Bureau of Mines
U. S. Department of Labor
Works Progress Administration

Western Refiners Recommend ASTM Octane Rating Test

The American Society for Testing Materials' method of determining octane rating was selected over the "L3" method developed by Licensees Ethyl Corporation and the "MRM," Modified Research Method, in a resolution adopted by the Western Petroleum Refiners Association at its convention during the week of April 1. The "MRM" method replaced the original CFR method in 1939.

The association also agreed to cut the number of "octane brackets" from five to three. The three ratings will be Premium 72-74; Regular 63-66; Third 60 and below. All three ratings will be based on the ASTM method.

Agreement on the single method of test for octane rating is expected to help cut down variation in the results of the tests, explains *Business Week*, April 6, in announcing the Refiners' action. The three methods formerly used gave results which might vary as much as eight octane numbers or as little as one or two. Different gasolines in different cars gave different results. A gasoline which sold as 71 octane (ASTM) might without undergoing any changes sell as 74 octane (L3) or as 79 octane (MRM).

The Standard Method of Test for Knock Characteristics of Motor Fuels, recommended by the Western Petroleum Refiners Association, was prepared under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and has received the approval of the American Standards Association. The latest edition is designated ASTM D 357-39; American Standard Z11.37-1939.

French and Canadian Standards Received by ASA Library

The standards listed here have recently been received by the American Standards Association and are available for purchase or loan to members of the ASA. The standards from the French national standardizing body are published in French. When ordering copies please refer to the number as well as the title.

Canada

Portland cement and high early strength Portland cement (A5-1940 and A57-1940)

Hard-drawn aluminum wire, aluminum cable, and aluminum cable steel reinforced (C49-1940)

France

Conditions Generales D'Admission des Aerodynes militaires prototypes. Essais des Organes (deuxieme categorie) (Air 0233)

Eclateurs pour essais des bougies et des magnetos (Air 0503)

Generateurs electriques 24 volts destines aux installations electriques de bord. Methode d'essai pour controle de l'efficacite des dispositifs antiparasites (Air 0510)

Textiles (Porosite) (Air 0653)

Emulsions photographiques et leurs supports. Norme des methodes d'essais (Air 0690)

Emulsions photographiques et leurs supports. Norme de qualification (Air 7840)

Combustibles pour Moteurs d'Aeronefs (Air 3401)

Tuyauteries Souples pour combustibles, lubrifiants, liquides de refroidissement. Conditions de Reception (Air 4509)

Cables D'Allumage pour Moteurs. Clauses Techniques de Reception (Air 4514)

Magnetos. Clauses Techniques de Reception (Air 4516)

Bougies D'Allumage. Clauses Techniques de Reception (Air 4517)

Pompes D'Alimentation. Clauses Techniques de Reception (Air 4519)

Tuyauteries souples pour combustibles, lubrifients, liquides de refroidissement. Norme de qualification (Air 6400)

Moteurs ou relais-generatrices. Caracteristiques d'interchangeabilite de l'accouplement (Air 6910)

Altimetres. Norme de qualification (Air 7609)

Conditions d'homologation des alliages d'aluminium de la categorie 1 (Air 8021)

Altimetres. Conditions D'Homologation (Air 8402)

Cahier des Charges Paticulieres aux Tubes Soudables au Chrome-Molybdene (Air 9300)

Produits Regrigerants pour Moteurs D'Aeronefs (Air 9390)

Altimetres Conditions de Reception (Air 9402)

ASA Standards Activities

Approved Standards Available Since Publication of Our April Issue

Specifications for Uncoated Wrought-Iron Sheets, American Standard G23-1939 25¢

Specifications for Copper-Base Alloy Forging Rods, Bars, and Shapes, American Tentative Standard H7-1939 25¢

Specifications for Copper Water Tube, American Standard H23.1-1939 25¢

Standards Now Being Considered by Standards Council for ASA Approval

Twist Drills, Straight Shank, Proposed American Standard B5.12

Commercial Standard for Book Cloths, Buckrams, and Impregnated Fabrics for Bookbinding Purposes Except Library Bindings CS 57-36

Proposed American Recommended Practice for the Use of Explosives in Anthracite Mines M27

Commercial Standards for Sun Glass Lenses (CS 78-39; CS 79-39)

Rubber-Insulated Tree Wire (Revision of C8.16-1936) C8.16

Methods of Testing Molded Materials Used for Electrical Insulation (Revision of C59.1-1938; ASTM D 48-39)

Specifications for Soft or Annealed Copper Wire (ASTM B3-39) H4.1

Specifications for Hard-Drawn Copper Wire (Revision of H14-1929; ASTM B1-39) H4.2

Specifications for Medium-Hard-Drawn Copper Wire (ASTM B2-39) H4.3

Tinned Soft or Annealed Copper Wire for Electrical Purposes (ASTM B 33-39) H4.4

Bronze Trolley Wire (ASTM B 9-39) H4.5

Copper Trolley Wire (ASTM B 47-39) H4.6

Hot-Rolled Copper Rods for Electrical Purposes (ASTM B49-39) H4.7

Methods of Testing and Tolerances for Tubular Sleeving and Braids (ASTM D 354-36) L13

Safety Rules for Radio Installations of the National Electrical Safety Code, Part 5

Electric Fences of the National Electrical Safety Code, Part 6

Rules for Rounding Off Numerical Values Z25

New Projects Being Considered

Standardization of Identification Markings for Compressed Gas Cylinders

Safety Shoes

New Project Authorized

Safety Code for Quarry Operations